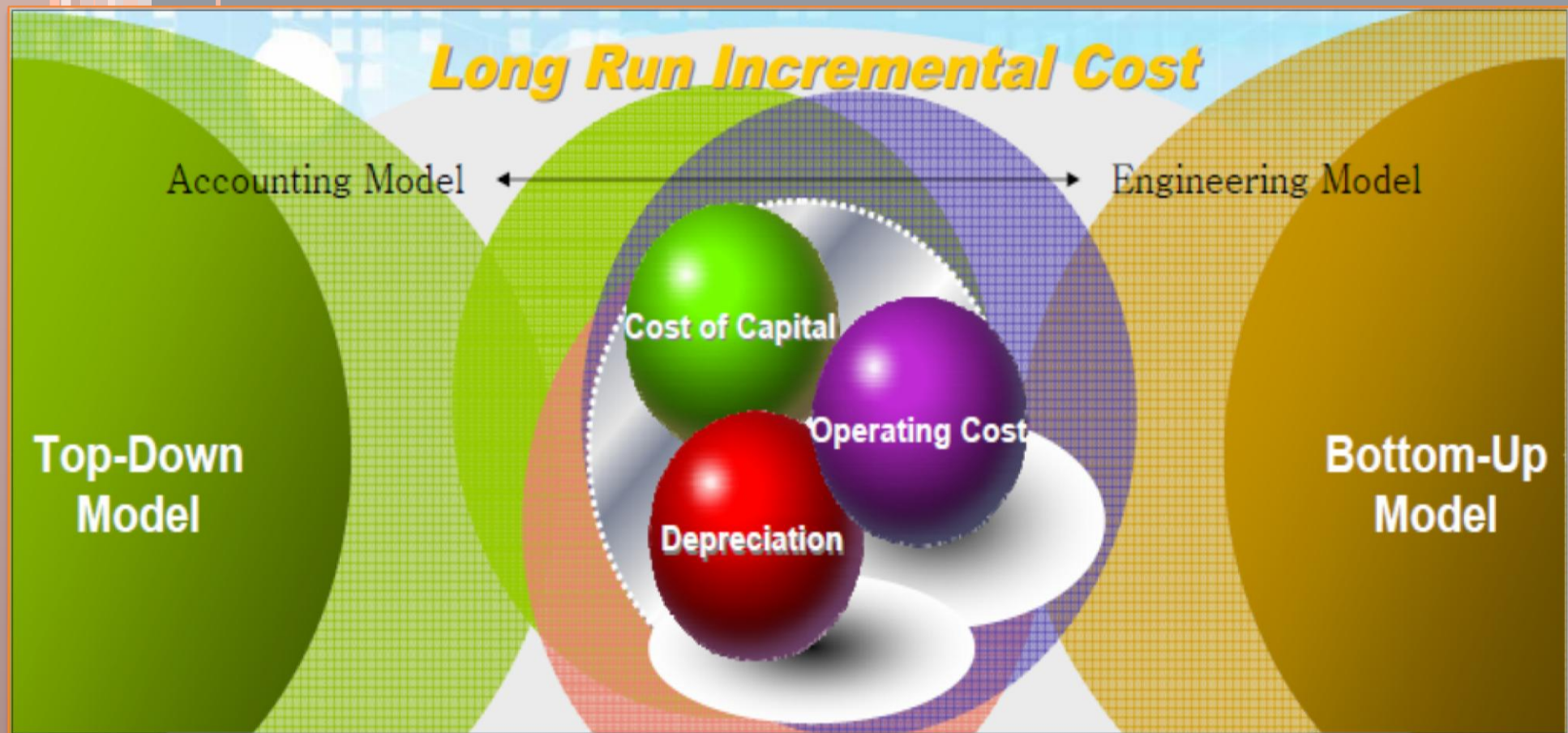


Agency for electronic communications Republic of Macedonia

WACC Calculations and development and
implementation of BU LRIC models (fixed and mobile)



Sarajevo, 4-6 November 2010

Development of WACC calculations and BU LRIC models

- Thru process of public procurement AEC with cooperation with Deloitte- Hungary and Deloitte- Zagreb have developed:
- WACC calculation for efficient fixed line operator
- WACC calculation for efficient mobile operators
- Bottom- UP LRIC model for fixed line operator
- Bottom- UP LRIC model for mobile operators

Calculations of WACC

- The key objective was setting an appropriate rate of return to ensure that operators with SMP on a relevant market achieves a return sufficient to recover the opportunity cost of capital employed in providing the regulated services
- The relevant cost of capital is combined cost of equity and debt, reflecting the average returns required by equity and debt holders, weighted by the market values of debt and equity, also known as WACC
- $WACC_{pre-tax} = r_e \times E / (D + E) + r_d \times (1-t) \times D / (D + E)$
- CAPM method used for calculation of cost of equity
- Nominal, pre- tax value of WACC in April 2010

13,40% nominal pre-tax WACC for efficient fixed line operator in RM

14,00% nominal pre-tax WACC for efficient mobile operators in RM

	Value	
	Lower	Upper
Risk – free rate	4.49%	4.49%
Beta Coefficient	0.729	0.729
Equity Risk Premium	6.50%	6.50%
Country Risk Premium	4.19%	4.19%
Size Risk Premium	1.36%	2.71%
Nominal Pre- tax Cost of Equity	16.40%	17.91%
Reference Rate	8.27%	4.49%
Risk Premium	0.31%	5.31%
Nominal Pre-tax Cost of Debt	8.58%	9.80%
Debt to Enterprise Ratio	37.88%	37.88%
Equity to Enterprise Ratio	62.12%	62.12%
Corporate Income Tax Rate	10.00%	10.00%
Nominal Pre-Tax WACC (rounded)	13.40%	14.80%

	Value	
	Lower	Upper
Risk – free rate	4.49%	4.49%
Beta Coefficient	0.681	0.681
Equity Risk Premium	6.50%	6.50%
Country Risk Premium	4.19%	4.19%
Size Risk Premium	1.36%	2.71%
Nominal Pre- tax Cost of Equity	16.06%	17.56%
Reference Rate	8.27%	4.49%
Risk Premium	0.31%	5.31%
Nominal Pre-tax Cost of Debt	8.58%	9.80%
Debt to Enterprise Ratio	27.45%	27.45%
Equity to Enterprise Ratio	72.55%	72.55%
Corporate Income Tax Rate	10.00%	10.00%
Nominal Pre-Tax WACC (rounded)	14.00%	15.40%

Tender procedure- consultant service for development and implementation of BU LRIC models (fixed and mobile)

- Public procurement published on www.aec.mk on 08.06.2009
- Also published on Official Journal of the EU website
- Submission of offers till 07.08.2009
- Awarding the most acceptable offer in end of August 2009 and signing a contract for consultant service with Deloitte- Zagreb
- AEC with Deloitte from September 2009 started with development of BU LRIC models
- Time frame for development- 7 months

BU LRIC Project background

- AEC have designated the following operators as operators with SMP and with BU LRIC models intends to verify that the prices for particular wholesale services are based on cost using LRIC methodology:



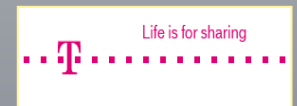
VIP Operator Skopje



ONE AD Skopje

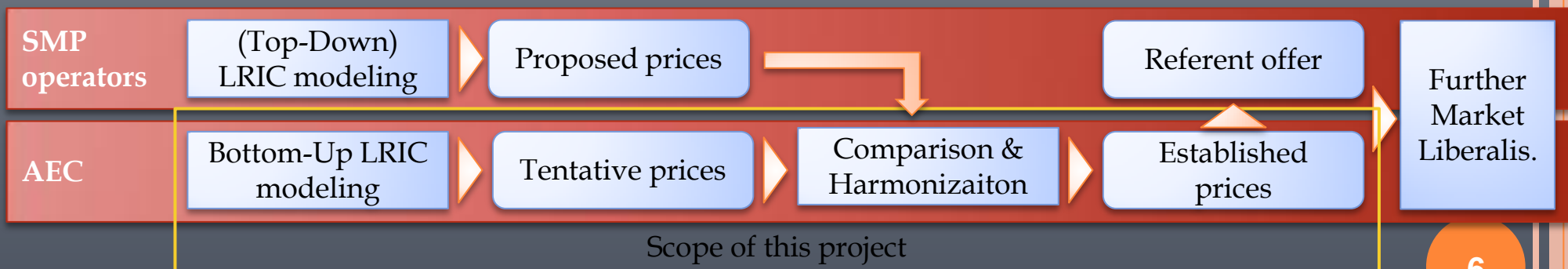


T-Mobile AD Skopje

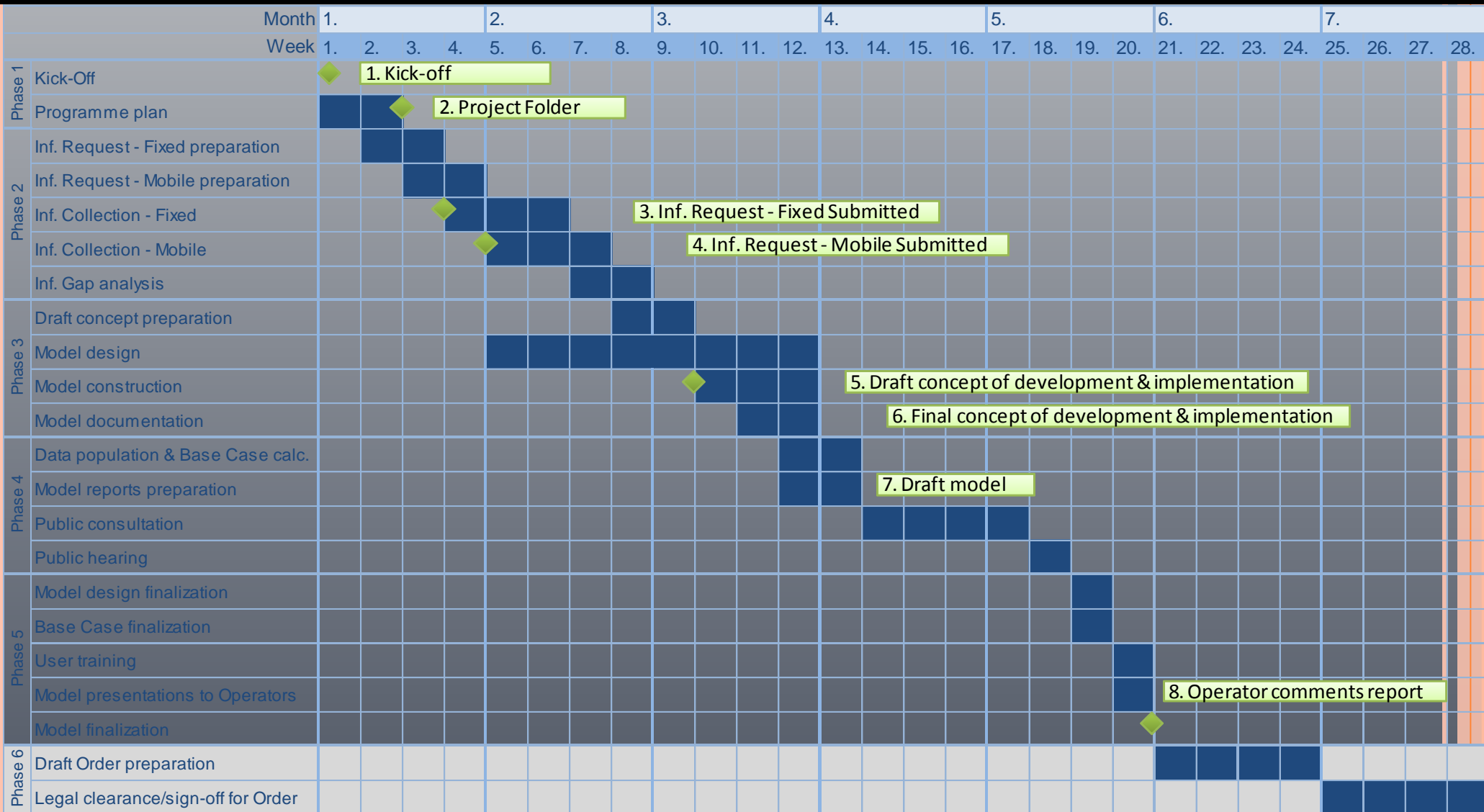


Makedonski Telekom AD Skopje

- AEC has a duty to verify and/or recommend prices based on efficient networks.
- Therefore, AEC facilitated the following process:

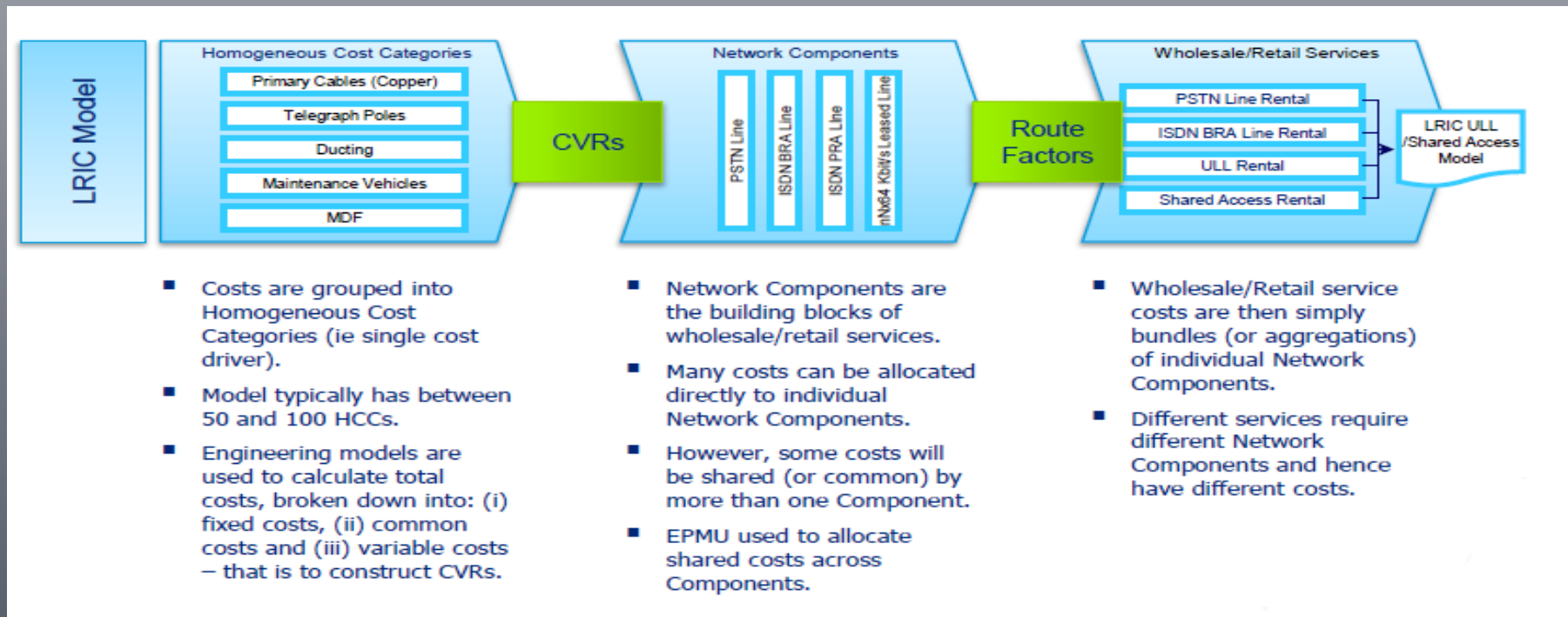


BU LRIC Project plan & deliverables



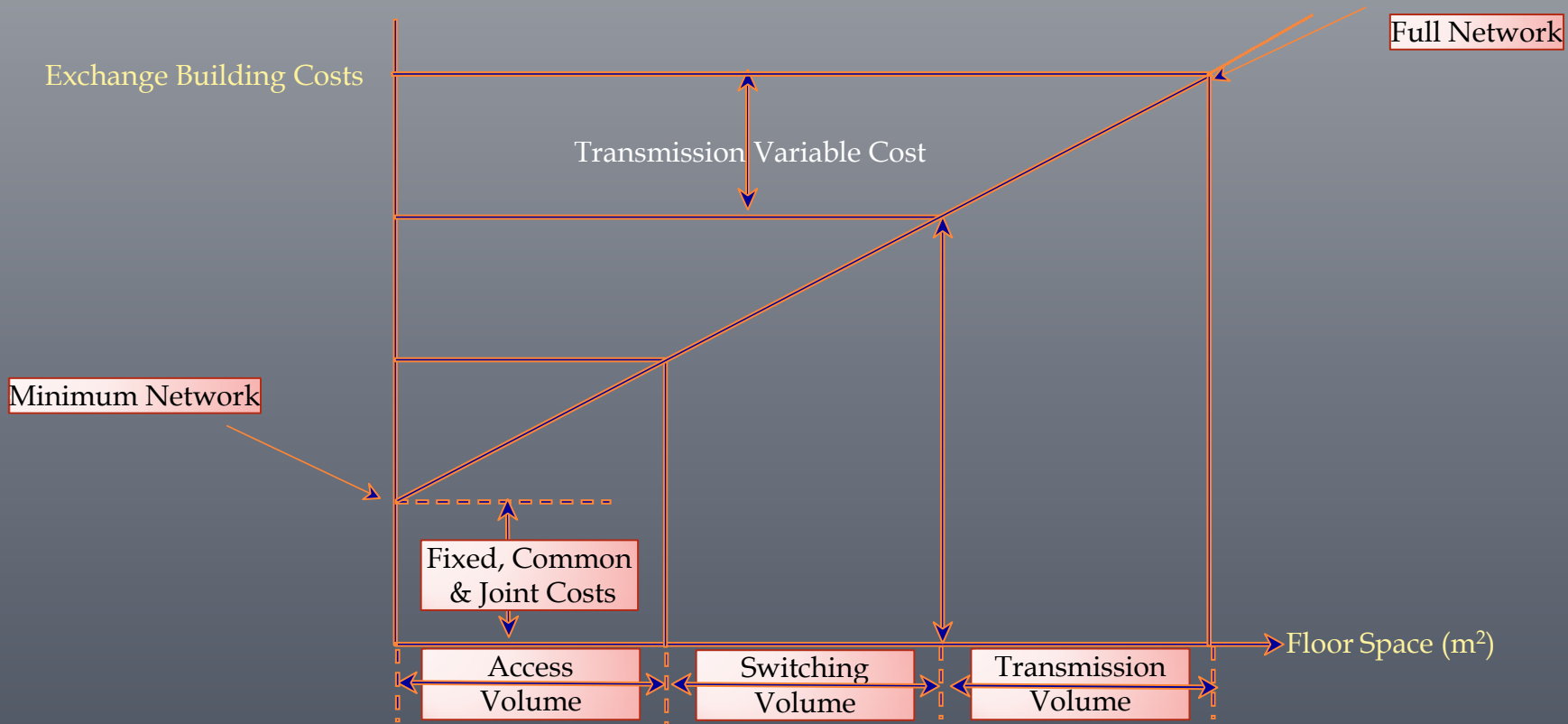
Cost allocation methodology

- grouping costs into granular Homogeneous Cost Categories (HCCs)
- allocation of these costs to building block Network Components and
- building up the cost of individual services from underlying Network Components



- HCCs are allocated to Network Components using CVRs. Network Components are allocated to wholesale/retail services using route factors.

- LRIC requires establishment of Cost Volume Relationships (CVRs)
- CVRs are at the core of developing an Incremental Cost (IC) capability. IC depends fundamentally on CVRs because CVRs:
 - identify all variable costs
 - identify all fixed costs
 - identify all common and joint costs
 - trace how individual cost vary with underlying cost drivers



HCCs

- In order to calculate the cost of individual retail/wholesale services it is necessary to group costs into a set of Homogeneous Cost Categories (HCCs). Fixed networks, as mobile networks, are characterized by hundreds of categories of distinct plant and equipment. It is therefore desirable to group similar network plant costs into a more manageable number of HCCs. What determines the level of homogeneity (or granularity) is the need to identify individual cost drivers for each HCC.

	PSTN Line	ISDN BRA Line	ISDN PRA Line	LX	LX - TX Transmission	TX	WSC
Primary Cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Secondary Cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subscriber Cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ducting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MDF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Concentrator Unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
LX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
⋮							
Maintenance & Repair	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Network Components

- Wholesale and retail services are built up from Network Components. These Network components then form the “building blocks” on which retail and wholesale services are based. It is important to determine at, an operational level, Network Component to wholesale/retail service mappings.

Route Factors

Having calculated the annual cost of each network component, the next step is to convert the cost into a per minute charge (or cost per unit charge). In reality, no service or business unit (wholesale or retail) uses a whole network component in its entirety. Hence the cost of each element has to be divided by the volume of traffic using it to arrive at the cost on a per minute basis. Thus the building block elements are elements like the following:

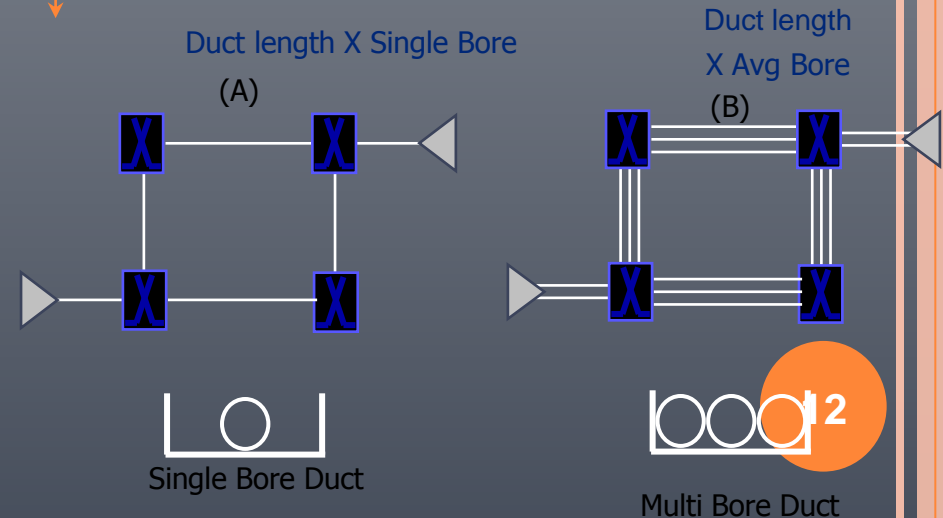
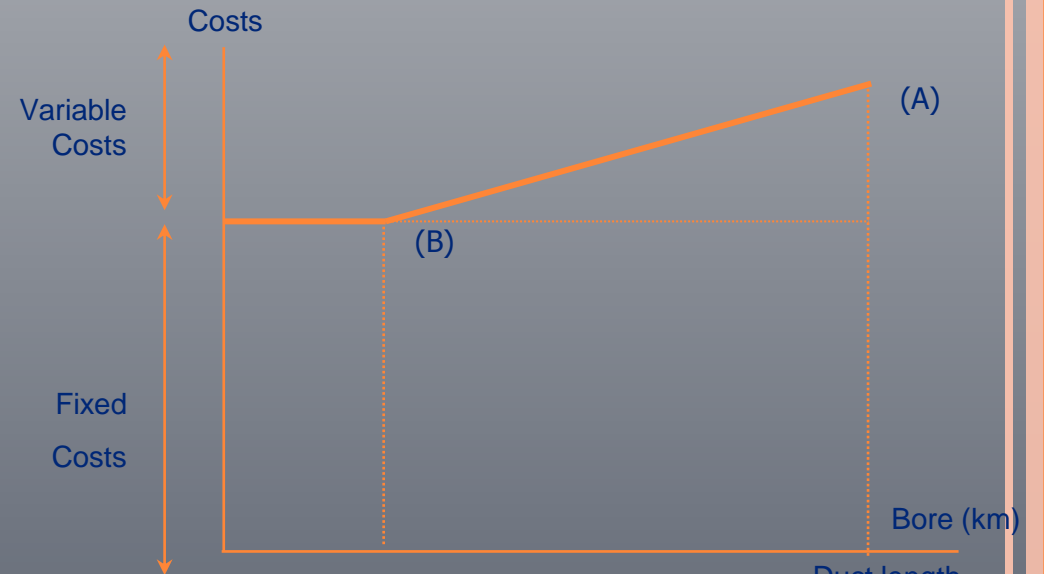
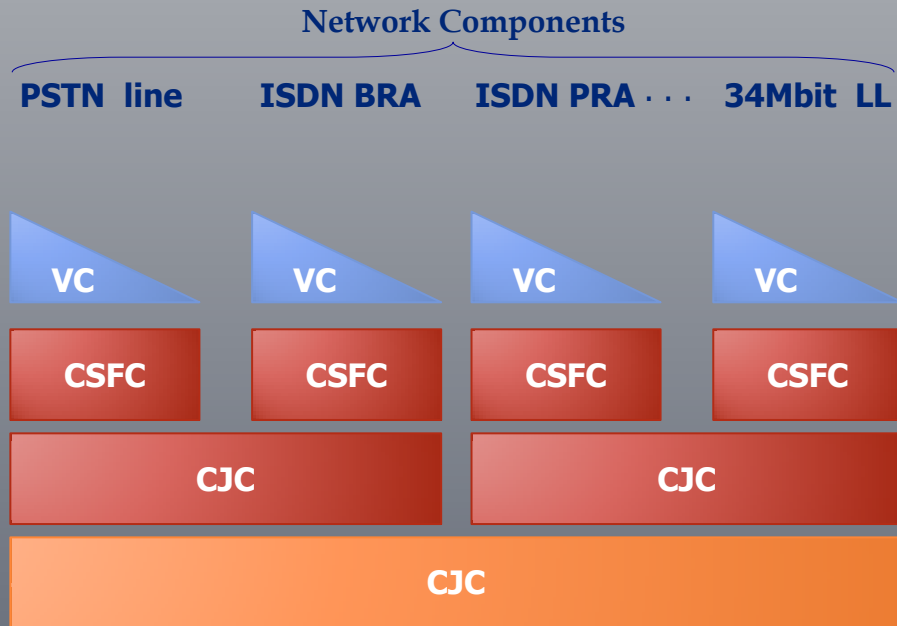
- XDSL Line (= Cost of XDSL equipment/XDSL Lines); and
- Transmission Kilometer Minute (= Cost of Transmission Circuit Route Kilometer Minutes of Traffic).

This is achieved using route factor matrices, which means:

- lists all possible route types for call origination or termination,
- determination probability of using each route type,
- determination of average routing by multiplying route factor by route probability,
- final step is to take the average route factors together with total minutes of traffic to convert annual network component cost into per minute charges.

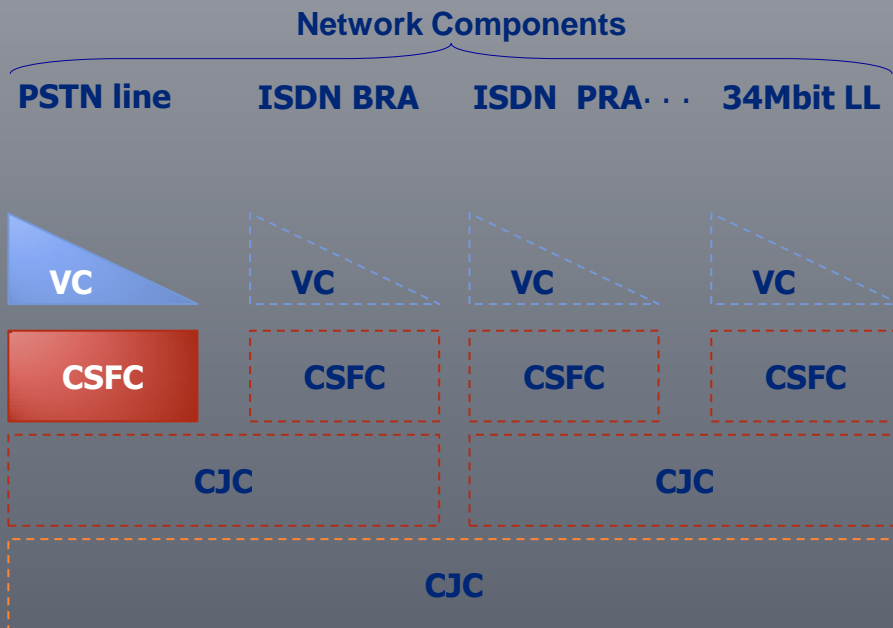
CVRs

- Diagram left- Different types of costs in relations to particular services
- Diagram right- CVR example

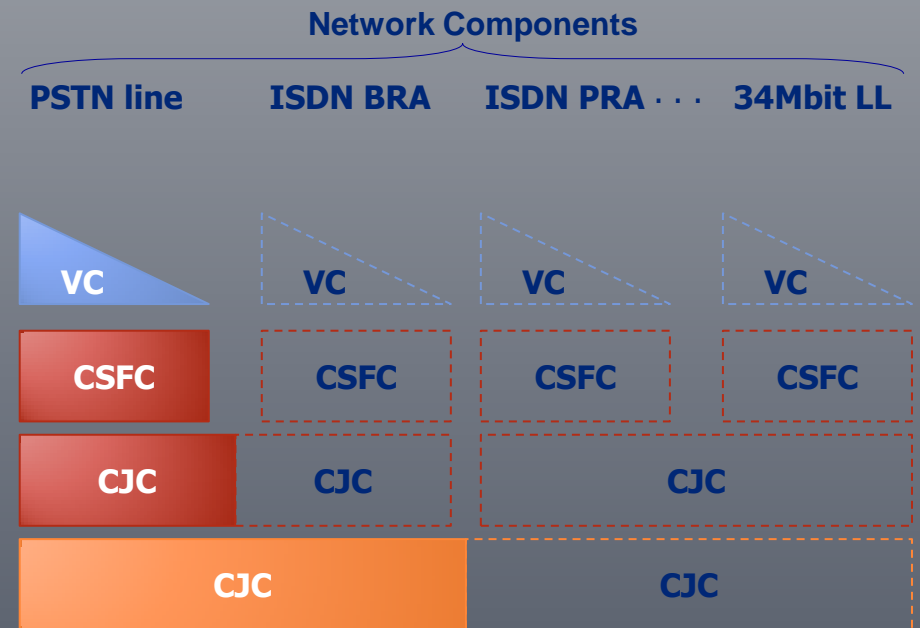


LRIC and LRIC +

$$\text{LRIC} = \text{VC} + \text{CSFC}$$



$$\text{LRIC+} = \text{VC} + \text{CSFC} + (\text{a share of}) \text{CJC}$$



Technologies modeled

Fixed model

- Model network is built on representative samples.
- Model treats several types of representative samples in relations with subscribers/line density, geographical location, busy hour traffic, required capacity...
- Physical equipment locations is positioned using scorched node approach.
- Additional correction is taken into account considering population and demand density.
- Different access/transmission network structure is taken into consideration.
- Model calculates variants using different approach to subscriber cables distribution (over ground -via a pole, or underground -via ducting).
- Every representative sample is modeled with different combination of surface type as well as sub-surface type (for underground cables).

Mobile model

Engineering models calculate two networks: a full network and a network for coverage

Network for Coverage

- A network designed to provide coverage in which a single subscriber can receive a network signal/make a call anywhere in the country consistent with minimum network coverage conditions
- The calculation of a network for coverage is based on radio wave propagation models, the Link Budget and Frequency Reuse, it is determined by calculating the radius (and footprint) of a cell for each site morphology using the applicable loss models together with relevant Link Budget parameters
- Costs associated with a network for coverage only represent fixed and common costs in providing all services, these costs will have to be recovered through an appropriate mark-up mechanism.

Full Network

- A full network is a network that can carry BHT generated by subscribers whilst meeting all engineering parameter inputs (such as Grade of Service, signaling TSs, etc).
- The difference in cost between the full network and a network for coverage represents the incremental cost of carrying existing traffic levels and the services (voice, SMS, data) that make up the traffic

Technologies modeled

Full versus Network for Coverage Key network / Cost drivers

Fixed model

- Copper Access network
- Fiber Access network
- Switching network
- Transmission network
- Hexagon calculation based on morphologies
- Circuit switching
- Line system transmission technology

Mobile model

- 2 G and 3 G Radio network
- Switching network
- Transmission network
- Hexagon calculation based on morphologies

Network for coverage, among others, driven by the following drivers:

- Macedonia's population and landmass
- Distribution of population and landmass
- Network Coverage by morphologies
- Coverage Quality
- Link Budget/Line System transmission

Full Network, among others, driven by the following drivers:

- Number of subscribers (prepaid and contract)
- Traffic per subscriber (prepaid and contract)
- Grade of service
- Available spectrum (900 MHz, 1800MHz and 2100 MHz)

To calculate cost of providing a particular service additional drivers have to be considered, such as:

- Weighted average cost of capital (WACC)
- Asset lives and rates of price change

Mobile model- Services modeled

- Model is sensitive mostly on:
 - Number of subscribers
 - Network for coverage
 - Minutes of traffic
- Services modeled:
 - Call origination (for NR)
 - Call origination (for MVNO)
 - SMS origination (for NR)
 - SMS origination (for MVNO)
 - Call termination
 - SMS termination

Mobile model assumptions

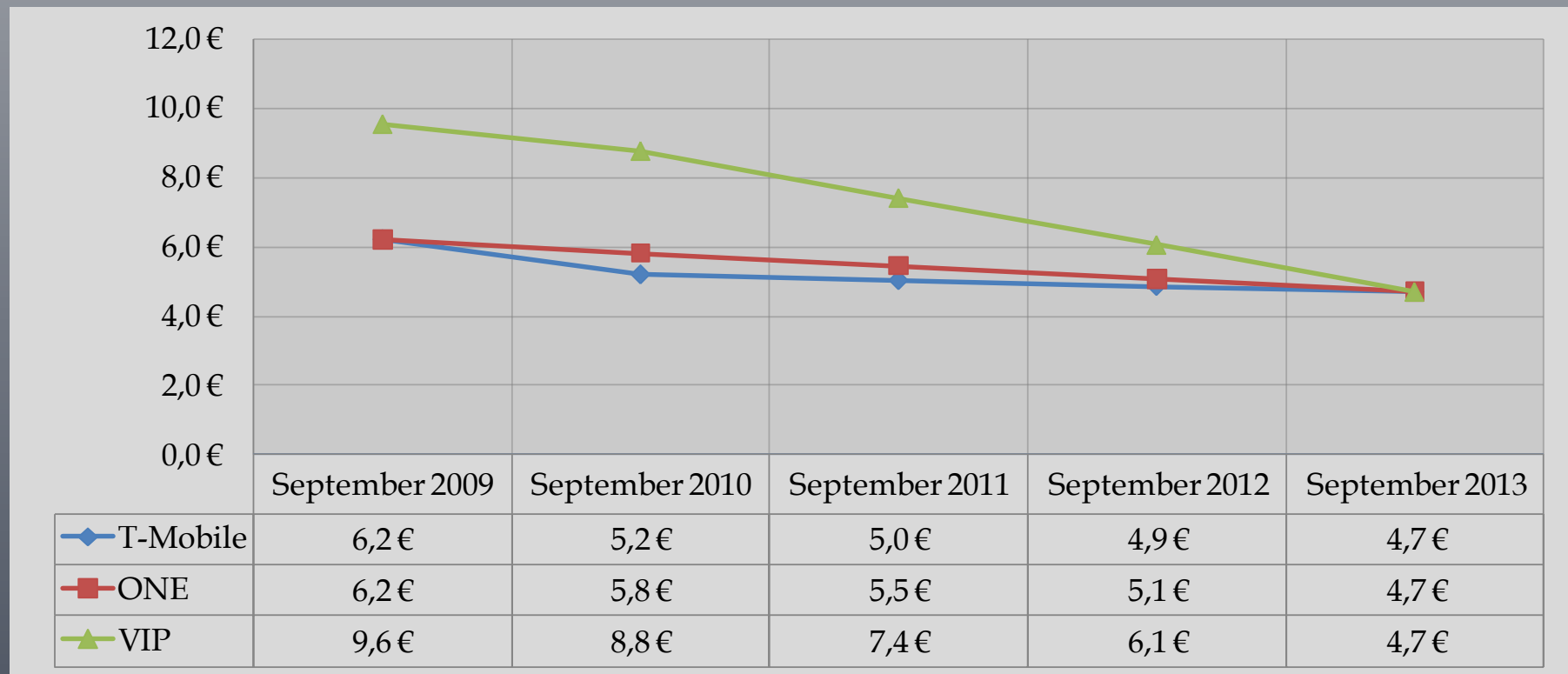
- BU LRIC model is developed to function for all three operators (for 2G and 3G)
- Model take biggest part of current network structure of the three mobile operators, but in the end will calibrate the network of efficient operator .
- Model make projection of development of each operator, based on historical changes of individual market shares of the operators
- Model defines equilibrium as the year in which all three operators achieve equal market share (33,33%) based on subscribers.

Equilibrium Market Share

Operator	Year 1	Year 2	Year 3	Year 4
T-Mobile	54.25%	45.93%	37.61%	33.33%
ONE	24.91%	28.02%	31.14%	33.33%
VIP	20.84%	26.05%	31.26%	33.33%

Mobile model- Results

- Model with input data from operators results with a symmetric MTR of 4.70 euro cents in Year 4 (2013), reflects the LRIC+ of a reasonably efficient operators with equal market share.
- Implementation of prices in September 2010



Fixed model- Services modeled

Unbundled local loop

- full
- shared
- naked DSL

Collocation

- physical
- virtual
- distant

Interconnection services:

- physical
- virtual

Interconnection links (2, 34 and 155 Mbit/s):

- near-by
- far-end
- extended

Usage tariffs:

- call origination for local and regional origination
- call termination for local, regional and national origination
- call transit for single and double transit

- Ducting costs per kilometer and square centimeter.

○ Leased lines with capacity:

- 64 kbit/s
- 2 Mbit/s
- 34 Mbit/s
- 155 Mbit/s

all capacities for 2, 5, 15 and 50 km lengths

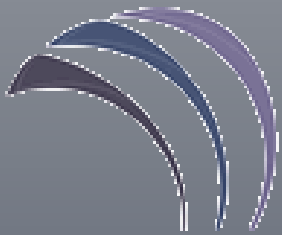
Fixed model- Results

- Model with input data from operators results with a cost based prices for modelled services, reflects the LRIC+ of an efficient fixed line operator.
- Model result are on a public hearing opened for a 30 days, not longer than 03.11.2010
- After public hearing and analysis of the submitted comments from interested parties AEC will implement BU LRIC model results in relevant reference offers

Service	Price (in €- VAT excluded)
ULL	5,37
Shared Access	2,17
Naked DSL	5,39
Local call origination - peak	0,0074
Local call origination - off peak	0,0026
Regional call origination - peak	0,0095
Regional call origination - off peak	0,0022
Local call termination - peak	0,0074
Local call termination - off peak	0,0025

Regional call termination - peak	0,0098
Regional call termination - off peak	0,0043
National call termination - peak	0,0118
National call termination - off peak	0,0051
Call transit - single	0,0019
Call transit - double	0,0035
Interconnection link 2 Mbit - near by	138
Interconnection link 34 Mbit - near by	3.165
Interconnection link 155 Mbit - near by	8.967
Interconnection link 2 Mbit - far end	142
Interconnection link 34 Mbit - far end	3.167
Interconnection link 155 Mbit - far end	8.969
Interconnection link 2 Mbit - distant	443
Interconnection link 34 Mbit - distant	4.316
Interconnection link 155 Mbit - distant	12.160
Physical collocation with HVAC	14,57
Physical collocation without HVAC	13,39
Virtual collocation with HVAC	15,44
Virtual collocation without HVAC	14,42
Distant collocation	13,54
Physical interconnection service	21,85
Virtual interconnection service	23,85

Thank you for your attention



Agency for electronic communications Republic of Macedonia

13, "Dimitrie Cupovski" Str.
1000 Skopje, Republic of Macedonia

tel: + 389 2 3289 200

fax: + 389 2 3224 611

e-mail: vaska.petrovic@aec.mk

<http://www.aec.mk>